

## WHAT IS CLAIMED IS:

1. A needleless injector comprising:
  - a housing;
  - 5 an injection head disposed at one end of said housing;
  - a piston disposed in said housing for ejecting medicament through said injection head;
  - an energy source coupled to said piston for forcing
  - 10 said piston toward said injection head in order to effect the ejection of medicament; and
  - a control mechanism for actuating said energy source.
- 15 2. A needleless injector comprising:
  - a barrel having a proximal and a distal end and a bore therethrough;
  - an injection head disposed at the barrel distal end in fluid communication with said bore;
  - 20 a vial for containing a medicament, said vial being in fluid communication with said bore through a port near the barrel distal end;
  - a gas cartridge disposed at the barrel proximal end;
  - a bolt disposed in said bore for reciprocating
  - 25 movement therein, from a first position closing said port to a second position opening said port for release of medicament into said bore, said bolt being fitted to said bore in order to draw medicament from said vial into said bore upon movement of said bolt from the first position to the second position,

and to force medicament through the injection head upon movement of the bolt from the second to the first position;

a cocking stud for enabling manual movement of said bolt to the second position;

5 a hammer disposed for reciprocal movement in said bore between said bolt and the barrel proximal end;

a mainspring disposed between said bolt and said hammer for forcing said hammer toward the barrel distal end;

10 a sear for releasably holding said bolt in the second position with mainspring compress between said bolt and said hammer;

a trigger disposed in an operational relationship with said rear for releasing the spring in order to drive the hammer toward the barrel distal end;

15 a valve tube disposed within said bore and having a distal end attached to said bolt and a proximal end, attached to the gas cartridge, said valve tube extending through said hammer;

20 a cup seal including a valve seat for controlling gas flow from the cartridge into said valve tube; and

a rear spring for releasably sealing the cup seal against said valve seat, said cup seal being opened momentarily by impact of said hammer to allow gas to flow through said valve tube to force said bolt to the first position in order to eject medicament through said injection head, said rear spring closing the cup seal agent the valve seal after said momentary opening.

3. A needleless injector comprising:

a barrel having a proximal and a distal end and a bore therethrough;

an injection head disposed at the barrel distal end in fluid communication with said bore;

5 a vial for containing a medicament, said vial being in fluid communication with said bore through a port near the barrel distal end;

10 a cylinder mounted for rotation at the barrel proximal end and having a plurality of chambers therein for receiving gas cartridges;

a bolt disposed in said bore for reciprocating movement from a first position closing said port to a second position opening said port for release of medicament into said bore, said bolt being fitted to said bore in order to draw  
15 medicament from said vial into said bore upon movement of said bolt from the medicament through the injection head upon movement of the bolt for the second to the first position;

a firing pin;

20 a spring disposed adjacent said bolt from the first to the second position;

a hammer disposed behind the bolt is disposed for moving said gas cartridge, aligned with the hammer and bore, into the firing pin;

25 a frame for supporting said barrel and said cylinder;

a trigger pivotably attached to said frame for moving the hammer in order to force the aligned cartridge into the firing pin for puncture of the aligned gas cartridge in order to drive the bolt from the second position to the first

position and force medicament in said bore through said injection head, the spring upon release of pressure forcing the bolt from the first position to the second position and drawing medicament into the bore for repeated injection.

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4. A needleless spring injector comprising:

a tubular casing having a bottom half shell extending from a rear end thereof;

10 a top half shell hingeably attached to the casing rear end for covering said bottom half shell;

a nose cap removably attached to a front end of said tubular casing;

an injection head disposed in an end of said nose cap;

15 a syringe replaceably disposed within said tubular casing and in fluid communication with said injection head;

a plunger slidably disposed within said tubular casing and engaging one end of said syringe for ejecting medicament therefrom through said ejection head;

20 a pushrod disposed between the bottom and top half shell for slidably moving said plunger;

a spring disposed about a rear portion of said pushrod for driving said pushrod;

25 a ratchet disposed on a forward portion of said pushrod;

a manually operated trigger, pivotably mounted within said tubular casing including a button extending outwardly from said tubular casing for manual depression thereof and a sear for releasably engaging said ratchet;

a cocking mechanism engaging said pushrod and said top half shell for compressing said spring upon hinged opening of said top half shell from said bottom half shell, said spring is retained in a compressed state by engagement of a said sear with said ratchet, whereby depression of said button releases said sear from said ratchet enabling expansion of said spring to drive said pushrod and said plunger in a forward direction in order to effect the ejection of said medicament from said syringe through said injection head.

5 5. A needleless push release injector comprising:  
a housing having a distal end, a proximal end and a central bore;

10 a cocking ring extending from the housing distal end and having a rear portion slidably disposed in the housing bore;

a cylinder slidably disposed within said cocking ring and having a front end and a rear end with a chamber disposed proximate the front end;

15 20 a vial for containing a medicament is disposed in the housing proximal end and in fluid communication with said chamber;

an injection head disposed at the cylinder first end and in fluid communication with the chamber;

25 a piston slidably disposed within said cocking ring and having a front head slidably disposed within said cylinder and a rear head slidably disposed within the housing bore, the front head being fitted to said cylinder in order to draw medicament from said vial into said chamber through a one-way

valve upon movement of said piston from a first position to a second position and to force medicament through the injection head upon movement of the piston from the second position to the first position;

5           a spring disposed between the housing proximal end and a rear head of said piston; and

          a sear for releasably holding said piston in the second position with the spring compressed, said sear including a sear spring and a tapered end, the sear spring  
10 causing releasable engagement of said tapered end with the piston rear head; and

          said cylinder rear end disposed in an operational relationship with the sear tapered end for releasing said sear from the piston rear head enabling said spring to drive said  
15 piston to said first position.

6. A push-pull needleless injector comprising:

          a housing having a distal and a proximal end;

          a chamber disposed within said housing at the distal  
20 end thereof;

          an injection head disposed at the housing distal end and in fluid communication with said chamber;

          a vial for containing a medicament, said vial being in fluid communication with said chamber through a one-way  
25 valve;

          a piston slidably disposed within said housing and having a piston head slidably disposed within said chamber and a stem disposed in the housing proximal end, said piston head being fitted to said chamber in order to draw medicament from

said vial into said chamber through said one-way valve upon movement of said piston from a first position to a second position and to force medicament through the injection head upon movement of the piston from the second position to the  
5 first position;

a spring disposed around the piston stem for forcing said piston from the second position to the first position;

a cocking grip slidable disposed over the housing proximal end for compressing said spring;

10 a sear for releasably holding said piston in the second position with said spring compressed; and

a trigger disposed in an operational relationship with said sear for releasing said spring in order to drive said piston to said first position.

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7. An inline needleless injector comprising:

a hollow casing having a proximal and a distal end;

an injection head disposed at the casing distal end;

20 a chamber disposed within the casing at the casing distal end;

a vial, for containing a medicament, disposed within the casing at the proximal end thereof;

a manifold for transport of the medicament from said vial to said chamber;

25 a one-way valve disposed in said manifold for preventing transport of medicament into said vial;

a piston slidably disposed within the chamber for forcing medicament through said injection head and withdrawing

medicament from said vial into the chamber through said manifold;

5 a gas manifold disposed behind a proximal end of said piston for introducing gas behind the piston proximal end to drive said piston toward the casing distal end in order to force medicament through said injection head;

a valve in communication with said manifold for controlling gas introducing behind the piston proximal end; and

10 means for moving said piston toward the casing proximal end in order to withdraw medicament from said vial into the chamber through said manifold.

8. The injector according to claim 7 wherein said vial  
15 is removably disposed within the casing.

9. The injector according to claim 7 wherein the means for moving said piston toward the casing proximal end and comprises a cocking stud attached to said piston.  
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10. The injector according to claim 7 wherein the means for moving said piston toward the casing proximal end comprises a spring disposed around said piston.

25 11. A needleless solenoid driven injector comprising:  
a housing having a proximal and a distal end;  
a cylinder disposed in said housing at the distal end thereof;



an injection head disposed at one end of said cylinder;

a vial for containing a medicament disposed within said housing at the proximal end thereof;

5 a manifold interconnecting said cylinder and said vial for transport of medicament from said vial to said cylinder;

10 a one-way valve disposed in said manifold for preventing flow of medicament from said cylinder into said vial;

a plunger having a first end slidably disposed within said cylinder for forcing medicament in said cylinder through said injection head upon moving of said plunger toward said injection head and for withdrawing medicament from said 15 vial and into said cylinder upon moving of said plunger away from said injection head, said plunger being moveable through the application of a magnetic field;

20 a solenoid disposed around the plunger between said first end and a second end of the plunger, said solenoid between disposed for forcing the plunger toward said injection head upon application of electrical current therethrough;

a trigger switch for controlling application of electrical current to said solenoid; and

25 a spring disposed around the plunger between said solenoid and said second end for forcing the plunger away from said injection head after electrical current is not applied to said solenoid in order to withdraw medicament from said vial into said cylinder through said manifold.

12. The injector according to claim 11 wherein said vial is removably disposed within said housing.